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Amendments to the Claims

This listing of claims replaces all prior versions, and listings, of claims in this application.

Listing of Claims

1. (Cancelled).
2. (Currently amended) A digital controller as claimed in claim 1 wherein the predetermined range is about two-thirds to about four-thirds of the predetermined nominal period.
3. (Currently amended) A digital controller ~~as claimed in claim 1~~ for producing a control pulse signal with a variable frequency and a duty cycle dependent upon a first digital value representing a first variable, comprising:
_____ a digital circuit responsive to the first digital value for producing second and third digital values representing an on-time of a pulse and an off-time between pulses of the control pulse signal; and
_____ a timing and control unit responsive to the second and third digital values to produce the control pulse signal with pulses dependent upon said on-time and off-time;
_____ wherein the second and third digital values are produced so that a sum of the on-time and the off-time varies, depending on the first digital value, within a predetermined range including a predetermined nominal period of the control pulse signal, and wherein the digital circuit comprises a look-up table in which the second and third digital values are stored for respective first digital values.
4. (Original) A digital controller as claimed in claim 3 wherein the second and third digital values are represented using a first and a second number of bits, respectively, in a first part of the table and are represented using a third and a fourth number of bits, respectively, in a second part of the table, the third and fourth numbers being different from the first and second numbers, respectively, and having a sum equal to a sum of the first and second numbers.
5. (Original) A digital controller as claimed in claim 4 wherein the table is also arranged to store a pointer to a transition between the first and second parts of the table.

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6. A digital controller ~~as claimed in claim 1 and~~ for producing a control pulse signal with a variable frequency and a duty cycle dependent upon a first digital value representing a first variable, comprising:

a digital circuit responsive to the first digital value for producing second and third digital values representing an on-time of a pulse and an off-time between pulses of the control pulse signal; and

a timing and control unit responsive to the second and third digital values to produce the control pulse signal with pulses dependent upon said on-time and off-time;

wherein the second and third digital values are produced so that a sum of the on-time and the off-time varies, depending on the first digital value, within a predetermined range including a predetermined nominal period of the control pulse signal;

the digital controller further comprising a further digital circuit responsive to a further digital value representing a second variable for modifying the first digital value in dependence upon the further digital value.

7. (Original) A digital controller as claimed in claim 6 wherein the further digital circuit comprises:

a digital circuit responsive to the further digital value for producing a digital multiplier value in dependence upon a difference between the second variable and a reference value;

a multiplier for multiplying the first digital value by the digital multiplier value to produce a digital correction value; and

an adder for adding the digital correction value to the first digital value to produce a modified first digital value.

8. (Currently amended) In combination, a DC converter, a digital controller as claimed in claim 1, and an A-D (analog-to-digital) converter for producing the first digital value in dependence upon an input voltage of the DC converter, wherein the DC converter comprises at least one switch controlled by the control pulse signal.

9. (Original) In combination, a DC converter, a digital controller as claimed in claim 7, an A-D (analog-to-digital) converter for producing the first digital value in dependence upon an input

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voltage of the DC converter, and an A-D converter for producing the further digital value in dependence upon an output voltage of the DC converter, wherein the DC converter comprises at least one switch controlled by the control pulse signal.

10. (Original) A digital controller for producing a control pulse signal for a switch of a DC converter for varying a duty cycle and a switching frequency of the DC converter in dependence upon an input voltage for the DC converter, the digital controller comprising:

an A-D (analog-to-digital) converter for producing a first digital value in dependence upon said input voltage;

a timing and control unit for producing the control pulse signal with pulse on- and off-times determined in dependence upon second and third digital values; and

a look-up table in which the second and third digital values are stored for respective first digital values, the look-up table being responsive to the first digital value to provide respective stored second and third digital values to the timing and control unit;

wherein the stored second and third digital values are such that a sum of the on- and off-times varies, depending on the first digital value, over a predetermined range which includes a predetermined nominal period of the control pulse signal.

11. (Original) A digital controller as claimed in claim 10 wherein the predetermined range is about two-thirds to about four-thirds of the predetermined nominal period.

12. (Original) A digital controller as claimed in claim 10 wherein the second and third digital values are stored using a first and a second number of bits, respectively, in a first part of the table and using a third and a fourth number of bits, respectively, in a second part of the table, the third and fourth numbers being different from the first and second numbers, respectively, and having a sum equal to a sum of the first and second numbers.

13. (Original) A digital controller as claimed in claim 12 wherein the table is also arranged to store a pointer to a transition between the first and second parts of the table.

14. (Original) A digital controller as claimed in claim 10 and comprising an A-D converter for producing a further digital value in dependence upon an output voltage of the DC converter, and

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a further digital circuit responsive to the further digital value for modifying the first digital value in dependence upon the further digital value.

15. (Original) A digital controller as claimed in claim 14 wherein the further digital circuit comprises:

a digital circuit responsive to the further digital value for producing a digital multiplier value in dependence upon a difference between the output voltage of the DC converter and a reference value;

a multiplier for multiplying the first digital value by the digital multiplier value to produce a digital correction value; and

an adder for adding the digital correction value to the first digital value to produce a modified first digital value for addressing the look-up table.

16. (Original) A digital controller for producing a control pulse signal, comprising:

a look-up table for storing, and for providing in response to a first digital value in dependence upon which the look-up table is addressed, respective second and third digital values representing an on-time of a pulse and an off-time between pulses of the control pulse signal; and

a timing and control unit responsive to the second and third digital values to produce the control pulse signal with pulses determined by said on-time and off-time;

wherein the second and third digital values stored in the look-up table are such that:

for providing the control pulse signal with a small duty cycle the second digital value representing the on-time is small compared with the third digital value;

for providing the control pulse signal with an increased duty cycle the second digital value is unchanged and the third digital value is decreased whereby a frequency of the control pulse signal is increased;

for providing the control pulse signal with a further increased duty cycle the second digital value is increased and the third digital value is increased whereby the frequency of the control pulse signal is decreased;

and for providing the control pulse signal with a yet further increased duty cycle

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the second digital value is again unchanged and the third digital value is decreased whereby the frequency of the control pulse signal is increased.

17. (Original) A digital controller as claimed in claim 16 wherein the second and third digital values are such that the frequency of the control pulse signal varies over a range of up to about 2:1.

18. (Original) A digital controller as claimed in claim 16 wherein the second and third digital values are stored using a first and a second number of bits, respectively, in a first part of the look-up table and using a third and a fourth number of bits, respectively, in a second part of the look-up table, the third and fourth numbers being different from the first and second numbers, respectively, and having a sum equal to a sum of the first and second numbers.

19. (Original) A digital controller as claimed in claim 18 wherein the look-up table is also arranged to store a pointer to a transition between the first and second parts of the table.

20. (Original) A digital controller as claimed in claim 16 and comprising a further digital circuit responsive to a further digital value for modifying the first digital value for addressing the look-up table in dependence upon the further digital value.

21. (Original) A digital controller as claimed in claim 20 wherein the further digital circuit comprises:

a digital circuit responsive to the further digital value for producing a digital multiplier value in dependence upon a difference between the second variable and a reference value;

a multiplier for multiplying the first digital value by the digital multiplier value to produce a digital correction value; and

an adder for adding the digital correction value to the first digital value to produce a modified first digital value for addressing the look-up table.

22. (Original) In combination, a DC converter, a digital controller as claimed in claim 16, and an A-D (analog-to-digital) converter for producing the first digital value in dependence upon an

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input voltage of the DC converter, wherein the DC converter comprises at least one switch controlled by the control pulse signal.

23. (Original) In combination, a DC converter, a digital controller as claimed in claim 21, an A-D (analog-to-digital) converter for producing the first digital value in dependence upon an input voltage of the DC converter, and an A-D converter for producing the further digital value in dependence upon an output voltage of the DC converter, wherein the DC converter comprises at least one switch controlled by the control pulse signal.

24. (New) A method of producing a control pulse signal having a variable frequency and a variable duty cycle, comprising the steps of:

producing, in response to a first digital value, respective second and third digital values representing an on-time of a pulse and an off-time between pulses of the control pulse signal; and

producing the control pulse signal in response to the second and third digital values with pulses determined by said on-time and off-time;

wherein the second and third digital values are produced so that:

for producing the control pulse signal with a small duty cycle the second digital value representing the on-time is small compared with the third digital value;

for producing the control pulse signal with an increased duty cycle the second digital value is unchanged and the third digital value is decreased whereby a frequency of the control pulse signal is increased;

for producing the control pulse signal with a further increased duty cycle the second digital value is increased and the third digital value is increased whereby the frequency of the control pulse signal is decreased;

and for producing the control pulse signal with a yet further increased duty cycle the second digital value is again unchanged and the third digital value is decreased whereby the frequency of the control pulse signal is increased.

25. (New) A method as claimed in claim 24 wherein the second and third digital values are produced so that a frequency of the control pulse signal varies over a range of up to about 2:1.

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26. (New) A method as claimed in claim 24 wherein the step of producing the second and third digital values comprises addressing a look-up table in dependence upon the first digital value.

27. (New) A method of controlling a DC converter comprising at least one switch, comprising producing a control pulse signal by a method as claimed in claim 24, controlling said at least one switch of the DC converter with the control pulse signal, and producing said first digital value in dependence upon an input voltage of the DC converter.